

Anatolia as a Bridge from North to South? Recent Research in the Hatti Heartland

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Anatolia as a bridge from north to south? Recent research in the Hatti heartland

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Abstract

This paper aims to reappraise and evaluate central Anatolian connections with the Black Sea region and the Caucasus focusing mainly on the third millennium BC. In its first part, a ceremonial item, the knobbed or ‘mushroom’ macehead, in its various appearances, is discussed in order to reconstruct a possible pattern of circulation and exchange of shapes and values over a longer period of time in the regions of Anatolia, southeast Europe and the Caucasus in the third and late second to early first millennium BC. The second part is devoted to the archaeometrical study of selected metal and mineral artefacts from the Early Bronze Age necropolis of Resuloğlu, which together with the contemporary settlement and graveyard at Kalinkaya-Toptaştepe represent two typical later Early Bronze Age sites in the Anatolian heartland. The high values of tin and arsenic used for most of the smaller jewellery items are suggestive of an attempt to imitate gold and silver, and the amounts of these alloying agents suggest a secure supply from arsenic sources located along the Black Sea littoral in the north and probably tin ores to the southeast of central Anatolia. This places these ‘Hattian’ sites within a trade network that ran from the Pontic mountain ridge to the Taurus foothills.

Özet

Bu makalenin amacı, Orta Anadolu’nun Karadeniz ve Kafkaslarla olan ilişkisini, özellikle MÖ 3. binyıla yoğunlaşarak tekrar sorgulamak ve değerlendirmektir. İlk bölümde, 3. bin ile 2. bin sonlarından 1. bin başlarına kadar olan dönemde Anadolu, Güneydoğu Avrupa ve Kafkaslarda görülen biçim ve değerlerin dolanım ve takasının olası dokusunu anlamak amacıyla törensel bir nesne olan, topuzlu ya da ‘mantar’ biçimli asa başı, çeşitli görünüşleri ile tartışılmaktadır. İkinci bölüm ise, bir Erken Bronz Çağı nekropolü olan Resuloğlu’nda ele geçen bir grup madeni ve minarel buluntunun arkeometrik değerlendirilmesine ayrılmıştır. Resuloğlu, çağdaşı Kalinkaya-Toptaştepe yerleşimi ve mezarlığı ile birlikte Anadolu’nun merkezindeki Geç Erken Bronz Çağı yerleşimlerinin tipik bir örneğidir. Küçük takıların çoğunda yüksek oranlarda kalay ve arsenik kullanılmış olması altın ve gümüşü taklit etme girişimlerini ve bu alışım malzemelerinin miktarları da kuzeyde Karadeniz kıyı şeridi boyunca uzanan arsenik ve olasıkla Orta Anadolu’nun güneydoğu kesimlerindeki kalay cevherlerine güvenli bir erişimin varlığını düşündürmektedir. Bu durum, ‘Hatti’ yerleşimlerinin, Pontus dağlarından Torosların eteklerine kadar uzanan ticaret ağının içinde yer aldığını gösterir.

Referring to Anatolia as bridging the East and West, that is to say Oriental with Occidental cultural entities, throughout the ages is common in archaeological research history. However, western Asia is no longer regarded as a mere highway simply connecting Near Eastern civilisations with prehistoric cultures in the northwest, but a dynamic cultural setting with its own unique developments (Mellink 1998). Indeed, for the Anatolian Early Bronze Age (ca 3,000–2000/1,950 BC),

and especially its advanced phase (EB III, ca 2,300/2,250–2000/1,950 BC), intra-regional and inter-regional trade networks left their traces in the archaeological record (Şahoğlu 2005: 353–55; Rahmstorf 2006: 79–84). Distribution patterns of selected artefacts like ‘Syrian bottles’ or the ‘depas amphikypellon’ show that, especially in the last quarter of the third millennium BC, cultural contacts between the northwestern fringes of Asia Minor and (northern) Mesopotamia led to an

increased flux and exchange of both indigenous Anatolian and Near Eastern fashions, technologies and innovations (Zimmermann 2005a: 163–65; 2006a; Rahmstorf 2006: 52–57). Also, the trend towards urbanisation, with the emergence of new building types and plans, together with the emergence of early élites, displaying their accumulated wealth in elaborate grave deposits like those from Alaca Höyük, have to be seen in context with these far-ranging contacts that linked remote regions with profoundly different socio-cultural traditions (Efe 2002: 54–61; 2003: 273–79). These long distance contacts, promoted largely by caravan routes stretching roughly southeast-northwest across the central Anatolian plateau, have been a focus of study in recent years.

In contrast, the ‘north-south axis’, linking (north) central Anatolia, the Black Sea littoral and the Caucasus, is much less well researched and discussed (Palumbi 2003, but excluding central Anatolia; for the most recent account see Kohl 2007: 1–22, 113–22). This is rather surprising given that Anatolian-Eurasian inter-relations have been much debated since the ‘royal burials’ of Alaca Höyük were discovered in the 1930s. The unrivalled richness in metal shapes and alloys, at that time only known from the cemetery at Ur, and specifically the abstract and theriomorphic standards led to the assumption that the people buried at Alaca might be immediate descendants of the Caucasian Maikop people who produced similar ceremonial items. This equation has to be rejected, since recent evidence suggests that the chronological gap between the Alaca cemetery and the rich Kurgans of the later Maikop culture was about 1,000 years (Chernykh 1992: 67–69). However, stylistic and functional similarities between the zoomorphic artefacts of the ‘royal’ Alaca graves and selected Kurgan burials in Georgia, Armenia and Daghestan were later proposed by Winfried Orthmann (Orthmann 1967) and recently revived by Günter Mansfeld (Mansfeld 2001). However, such wide-ranging conclusions have to be handled with care, as long as there is no reliable relative and absolute chronology for the Caucasian region available (see Bertram 2005 for further discussion of this problem).

The plentiful theoretical approaches to Anatolian-Caucasian connections in the third millennium BC are in contrast to the scarce or non-existent research in north-central Anatolia, the Black Sea coast and its hinterland, and the Pontic mountain ridge as far as the Georgian border. Only in the last two decades have investigations again highlighted the north and northeast fringes of Anatolia, allowing a better understanding of cultural exchange between the central Anatolian plateau and its northeastern neighbours (Matthews, et al. 1998; Matthews 2004: 55–66; Sagona 2004: 475–79).

Anatolian-Caucasian connections: an ‘antiquarian’ contribution

In order to form an impression about western Asian-Caucasian inter-relations in the region described above, one needs to look beyond the ‘sun standards’ and related ceremonial items known from Alaca Höyük. Smaller, but equally exotic objects known as ‘Pilzknaufkeulen’ (roughly translatable as mushroom-pommel maceheads) are known from one gold specimen (Alaca burial ‘B’; Arik 1937: pl. 172–73, Al. 243) and as bronze items from several other sites in central Anatolia and the Black Sea littoral (fig. 1) (Zimmermann in press). Only varying slightly in size, their shape commonly bears the same features: a tubular shaft, often decorated with criss-cross incisions simulating strings, presumably to affix the head, and a number of globular or ‘mushroom’-shaped projections applied at odd angles and in varying numbers. Since their shape and weight is much too inconvenient for use as a serious weapon, one should rather ascribe them to the sphere of ritual equipment designed to display power, wealth and prestige. With only two of the as yet known ‘mushroom maceheads’ coming from secure archaeological contexts, the best date for these items is provided by a burial from the necropolis of Demircihöyük-Saruket. Here, grave no. 335 also contained a small fragment of a local ‘Syrian bottle’ derivative, which dates the assemblage to the final quarter of the third millennium BC (Seeher 2000: 106, 156, fig. 40, G.335, pl. 19,3; Zimmermann 2005a: 166–67).

That said, the ‘mushroom style’ was not only limited to these distinctive ‘maceheads’, but can also be seen on various other contemporary metal objects, all of them related to ritual or other prestigious functions. Some of the ceremonial standards from Alaca Höyük have knobbed macehead-shaped projections attached to their frames, and other precious small finds like a gold miniature ‘mushroom macehead’ in the *Prähistorische Staatssammlung* Munich (Zaalhaas 1995: 78, 81 pl. G) suggest that the ‘macehead’ symbol was a codified symbol used by the emerging early élites in central Anatolia (fig. 2).

A careful survey of Bronze Age metal assemblages from regions bordering northeast Turkey reveals that similar knobbed maceheads were produced in the Caucasus region (fig. 3). Although most examples in private collections or museums lack a secure archaeological context (Motzenbäcker 1996), the few better documented finds from the Bornighele necropolis in Meskhethia/Georgia (Gambaschidze, et al. 2001: 284, no. 107) or the tiny knobbed macehead beads from the Late Bronze Age sanctuary at Šilda (Pizchelauri 1984: 42–44, 61, fig. 37,26–33) or Verchnjaja Rutchka (Motzen-

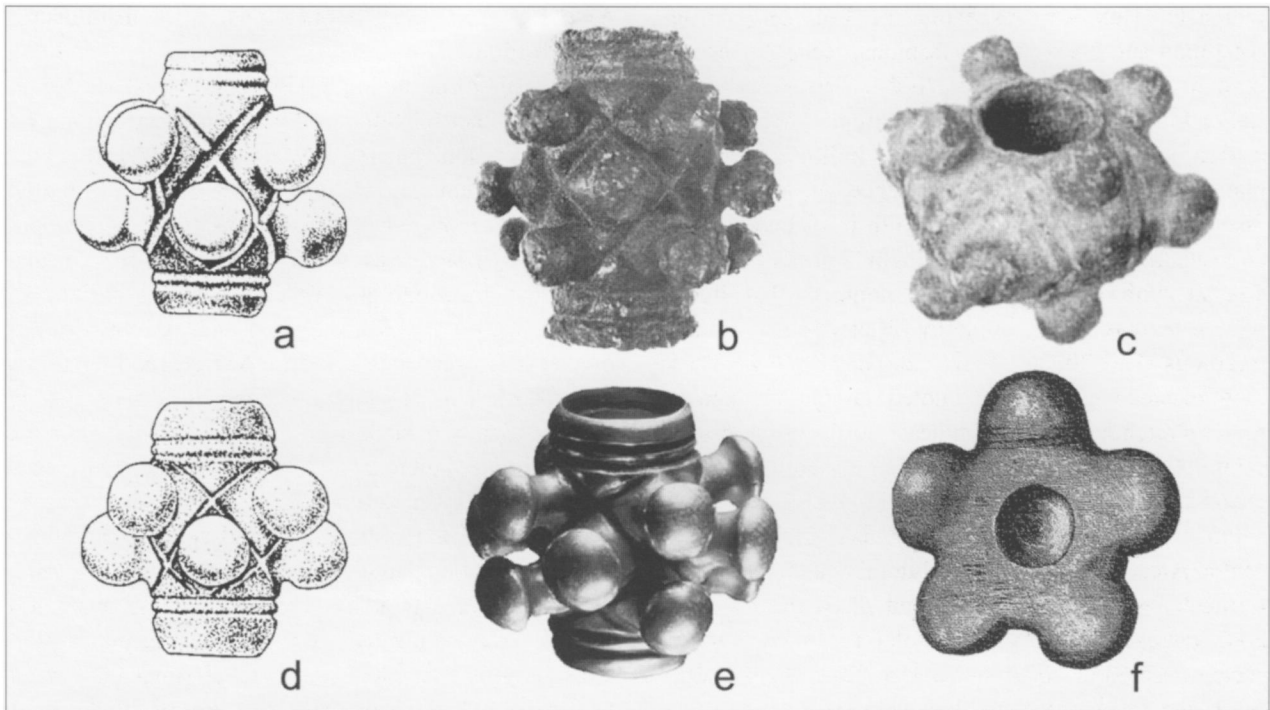


Fig. 1. Knobbed 'mushroom maceheads' from Demircihöyük-Sarıket (a, d), Oymaağaç/Göller (b), Alaçam-Soğukçam (c), Alaca Höyük (e) and a semi-finished diorite macehead from Troy (f) (after Seeher 2000 [a, d]; Özgüç 1980 [b]; Bilgi 2001 [c]; Temizsoy, et al. n.d. [e]; Schliemann 1881 [f]; not to scale)

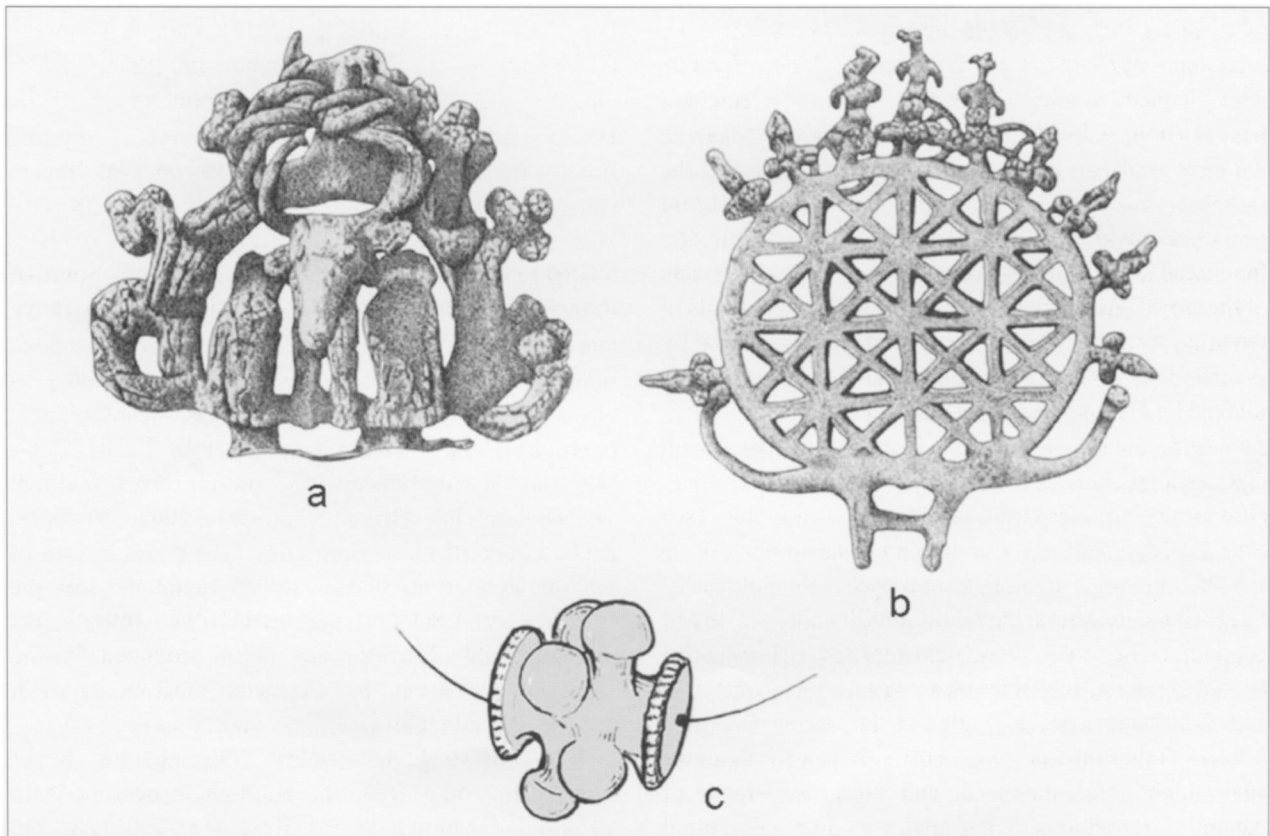


Fig. 2. Knobbed macehead motifs on ceremonial standards from Alaca Höyük (a, b) and a gold miniature macehead bead from the collection of the Prähistorische Staatssammlung, Munich (c) (after Müller-Karpe 1974 [a, b]; Zaalhaas 1995 [c]; drawing: B.C. Coockson, not to scale)

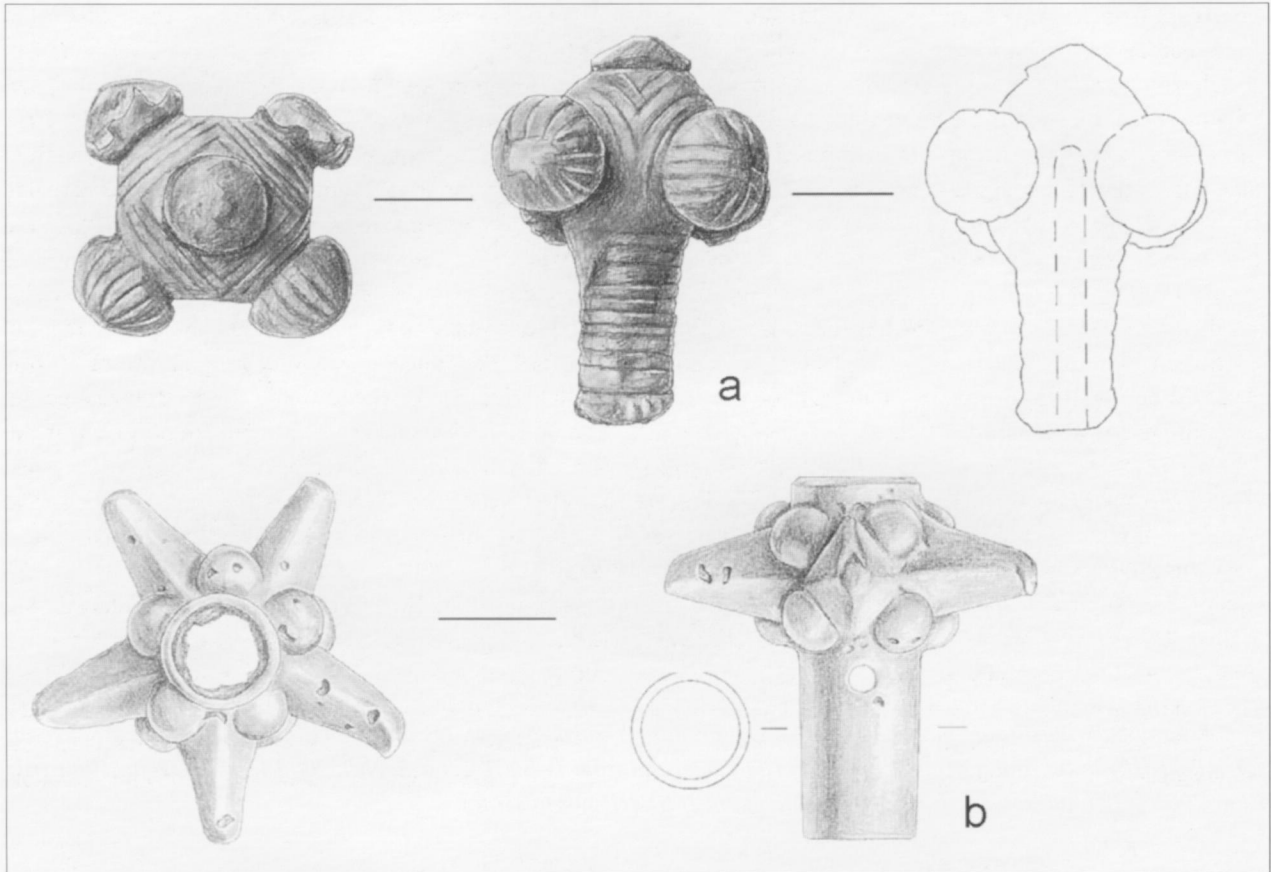


Fig. 3. Knobbed maceheads from Faskau or Kumbulte (?) (after Motzenbäcker 1995, not to scale)

bäcker 1996: pl. 49,20.21) prove that they mostly can be dated to the second millennium BC. Likewise, these miniature versions of larger ‘maceheads’ might testify that prestigious symbols were adapted and modified by the Caucasian Late Bronze Age (LBA) communities in a similar manner as in (late) Early Bronze Age (EBA) Anatolia.

One primary goal of this short study is now to discuss whether these shapes and applications are coincidental, as convergent adaptations in two different cultural and chronological horizons, or whether they testify to long-term inter-relations between these two entities.

Possible clues to the latter assumption are the Eurasian knobbed stone maceheads, which could hardly have been weapons but were more probably status symbols, which are a widespread EBA phenomenon, from southern Russia to southeast Europe, in the third and second millennia BC (Kaiser 1997: 123–24, 122 map).

One semi-finished example of such a knobbed ‘macehead’ is also known from EBA Troy; made of diorite and assigned to levels I–V (Schliemann 1881: 380, nos 224–225; lastly mentioned in Horedt 1940: 288). In the east of Anatolia, the site of Tilkitepe yielded a complete version of such a decorated stone mace

(Reilly 1940: 164). These examples serve as ‘missing links’ that connect Anatolian-European-Eurasian spheres of interactions from the Early to the Late Bronze Ages (fig. 1).

In a broader context, these patterns of mutual exchange of styles and ideas accord quite well with the streams of technological, specifically metallurgical, innovations proposed already by E.N. Chernykh as characterising his ‘Circumpontic Metallurgical Province’ (Černykh 1983: 19–28; Chernykh, et al. 2002). If we plot our distribution of ‘mushroom’ or ‘knobbed’ ‘maceheads’ against the circulation of metal technologies in the circumpontic regions (fig. 4), a possible way of interpreting our maceheads would be to consider the ‘Eurasian’ stone knobbed specimens as early forerunners of our Anatolian ‘mushroom maceheads’, which were likewise adopted in the second millennium in south Ossetia, Georgia and Armenia.

In conclusion, the diachronic application of the ‘mushroom’ motif proves that the movement and adaption of technologies and styles were never restricted to travel on a one-way street, but were multi-directional exchanges that might stretch over several centuries or even millennia.

Central Anatolian-Pontic inter-relations: new archaeometrical evidence

As already mentioned above, research in (north) central Anatolia was not entirely abandoned after a long period of intensive research. However, both typo-chronological and, especially, technological analyses of material from central Anatolian or ‘Hattian’ findspots, as carried out in pioneering works some decades ago (Esin 1969; De Jesus 1980), were not pursued on a larger scale. Furthermore, older results obtained by the spectrographic examination of selected metal items from central Anatolia do not always match the outcomes obtained by modern analytical equipment (Kuruçayırılı, Özbal 2005: 55, 54–57 charts). Recent work conducted by Tayfun Yıldırım at the EBA necropolis of Resuloğlu, Uğurludağ district, province of Çorum (for a conspectus see Yıldırım 2006), and the study of finds of domestic and funeral remains from Kalinkaya-Toptaştepe, district of Alaca, Çorum province (Zimmermann 2006b), now provide a great opportunity to investigate selected metal and mineral items in their full archaeological context and to discuss their chemical composition and the possible provenance of the raw materials used.

The mound of Kalinkaya-Toptaştepe, just 3km northwest of Alaca Höyük, was excavated on behalf of the Museum of Anatolian Civilisations and its Director, Raci Temizer, in two short rescue campaigns in 1971 and 1973 after frequent looting activities were reported to the Directorate of Antiquities. Toptaştepe revealed occupation remains from the (Late) Chalcolithic and especially the late Early Bronze Age, with scattered evidence of Middle Bronze Age activities (Zimmermann 2006b: 276). The extramural cemetery at the foot of Toptaştepe yielded, apart from a few Chalcolithic inhumations, mainly Early Bronze Age pit, pithos and cist graves with comparably rich metal assemblages (fig. 5), comprising tools, weapons, jewellery and ceremonial items like bull statuettes and abstract standards of a type known from Alaca Höyük (Zimmermann 2007).

Approximately 90km west of Kalinkaya, the Resuloğlu graveyard has been under excavation since 2003, with pithos and cist graves dated to the later phase of the Early Bronze Age (Yıldırım 2006: 13). The finds include a broad range of metal items (so far with no ceremonial equipment), some of them extraor-

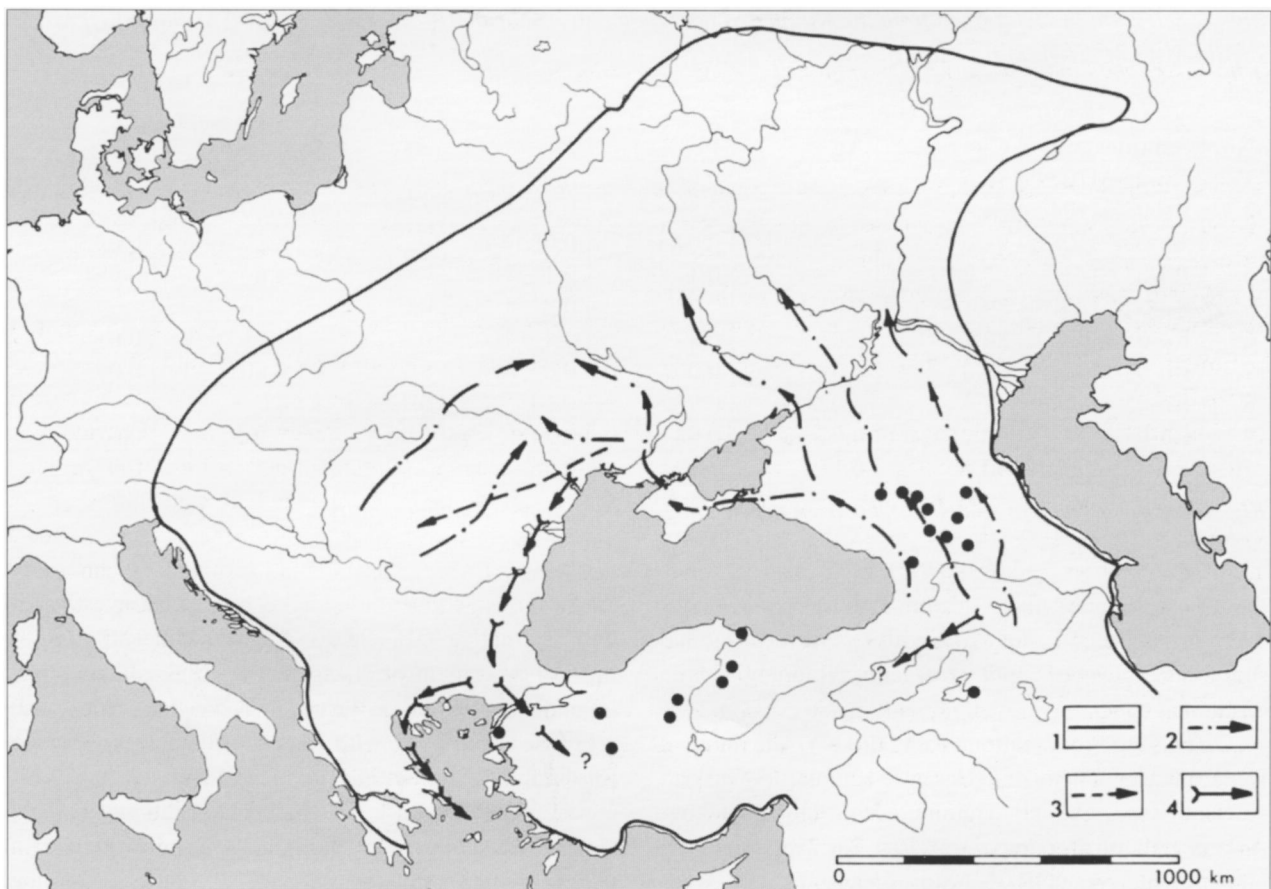


Fig. 4. Knobbed maceheads in Anatolia and Caucasia, plotted against E.N. Chernykh's map showing his 'Circum-pontic Metallurgical Province' in the third millennium and second millennium BC, with its proposed streams of technological innovations (after Černych 1983, with additions)

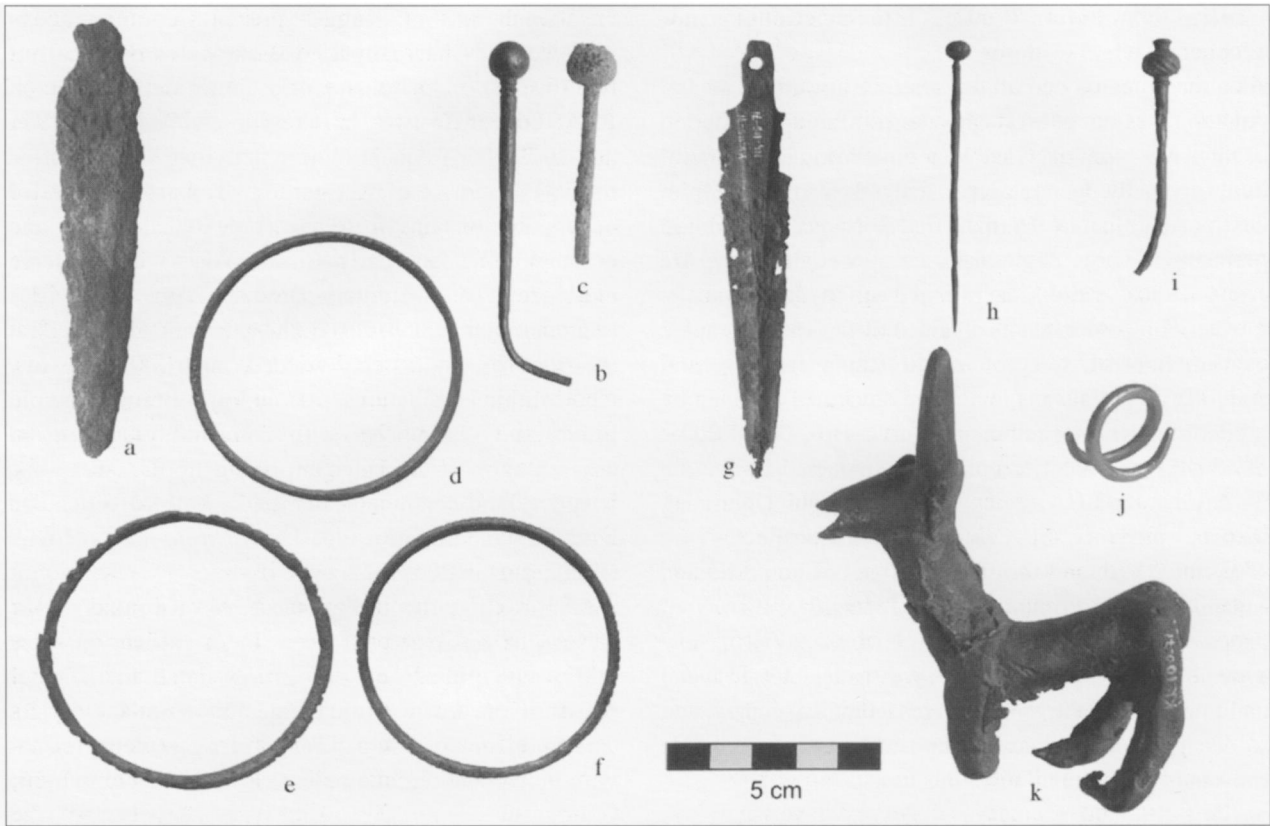


Fig. 5. Selection of metal finds from the Kalınkaya necropolis. (a–f) burial M-02-71; (g–i) burial M-08-71; (j) M-20-73; (k) M-C-71; (a–i, k) bronze; (j) gold

| No. | Sample | Cu | Ag | Pb | Fe | As | Sn | Sb |
|-----|------------|------|------|-------|------|------|-------|-------|
| 1 | Ro-05-M107 | 92.5 | - | 0.08 | 0.09 | - | 7.3 | - |
| 2 | Ro-05-M104 | 84.4 | - | 2.3 | 0.12 | - | 10.9 | 2.3 |
| 3 | Ro-05-M108 | 91.6 | - | 0.07 | 0.08 | - | 8.2 | 0.02 |
| 4 | Ro-04-SM | 95.2 | - | 0.1 | 0.13 | - | 4.6 | 0.001 |
| 5 | Ro-04-M80 | 89.1 | 0.01 | - | 0.27 | 0.09 | 10.6 | - |
| 6 | Ro-05-M90 | 86.7 | 0.02 | 0.47 | 0.4 | 0.27 | 12.1 | 0.01 |
| 7 | Ro-04-M47 | 91.6 | 0.06 | 0.007 | 0.01 | 8.2 | 0.001 | 0.09 |
| 8 | Ro-05-M104 | 87.2 | 0.02 | 0.96 | 0.64 | 0.17 | 11 | - |
| 9 | Ro-04-M64 | 92 | 0.02 | 0.08 | 0.54 | 0.42 | 6.9 | 0.02 |
| 10 | Ro-04-M70 | 90.4 | 0.15 | 1.29 | 0.46 | 1.09 | 6.5 | 0.07 |

Fig. 6. Analysis chart of selected items from the Resuloğlu Early Bronze Age necropolis

dinarily well preserved (Yıldırım, Ediz 2006: 63, fig. 8; Yıldırım 2006: 10, fig. 14) with preserved wooden shafts and traces of cloth or organic wrapping visible on the patina.

Thanks to cooperation with Bilkent University’s Department of Chemistry (Hasan Erten) and the Turkish Nuclear Research and Training Centre in Sarayköy-Ankara (Abdullah Zararsız), X-Ray Diffraction (XRD) and destructive X-Ray Fluorescence (XRF) were conducted in order to gain a detailed insight to the alloying matrix of metal items from the Resuloğlu cemetery.

So far, ten copper-based items have been investigated with destructive XRF (fig. 6). The high concentrations of tin and arsenic in artefacts nos 2, 5, 6 and 8 attract immediate attention, as values of 3–5% are sufficient to create a decent alloy with ideal technical specifications for durability and casting (Pernicka 1990: 47–56). This observation now raises several considerations, namely (1) the reasons for the addition of arsenic and tin in unusually high amounts, assuming that they are not the result of an erroneous casting procedure, and (2) the implications for the availability of such valuable raw materials as arsenic and especially tin.

Regarding the first point, high concentrations of alloying agents like tin or arsenic added to copper will alter the final colour of the artefact towards silver or golden tones, a phenomenon that is well attested in ancient Mesoamerican metal production of ceremonial items like bells (Hosler 1995: 100–01, 103–04; Lechtman 1996: 506). An interest in colour would make perfect sense for our items from Resuloğlu, since the artefacts analysed so far all belong to the jewellery group, like pins and small pendants. These parallel developments in two profoundly different geographical and cultural settings may well be the result of a deliberate ‘trial and error’ procedure, to achieve finally a golden or silver shine for decorative items.

For the second consideration, the technology applied here, to imitate intentionally precious metals through the addition of high proportions of arsenic and tin, demands a stable and secure supply of raw materials, in this case copper, tin and arsenic. As a result of extensive surveys and material studies, a detailed picture of Anatolian raw material resources and evidence for their exploitation in antique times is now available.

Traditionally the Pontic and Taurus mountain ridges in the north and southeast of Turkey have served as ‘prime suspects’ for antique mineral exploitation, as they are still highly mineralised and therefore rich in ores (Yener 1983; 1986; Pernicka, et al. 1984; 2003). However, copper, at least, was also available in the immediate vicinity of both Kalinkaya and Resuloğlu. Recently surveys of Derekütüğün, Üçoluk and Çağsak, where there are heaps of copper slag beneath

developed soil strata, suggest prehistoric mining activities that may have supplied the metalworkers of our two central Anatolian sites (fig. 7) (Wagner, Öztunalı 2000: 50–51; Wagner, et al. 2003: 477–78; Yıldırım 2006: 13).

For arsenic, the closest and most probable sources for our two sites in Çorum province have to be sought in the north or northeast of Anatolia. Arsenic deposits are mainly found as arsenopyrite outcrops in the Peynir Çayı valley along the Tavşan mountains, approximately 70km to the south of Bafra (Özbal, et al. 2002: 43–44). Another, closer source to supply Kalinkaya and Resuloğlu could be the massive arsenic mineralisation discovered close to Durağan, along the banks of the Kızılırmak where the Gökırmak flows into the Halys river (Özbal, et al. 2002: 44).

The high contents of arsenic in some of the Resuloğlu metal jewellery testify to an intentional (and rather dangerous!) alloying procedure. The hazardous qualities of arsenic in its different chemical states and mineral occurrences are well known, counterbalancing its positive effects on the mechanical properties and castability of copper (Charles 1967; Pernicka 1990: 47–56; Güngörmüş, Şen 2006: 100–01). Apart from the unusually high arsenic content, the possible use of natural arsenic copper ores should be excluded because of geographical reasons: the closest sources for ultrabasic ophiolitic rocks which contain naturally alloyed copper and arsenic are found along the Zagros belt, in the eastern Taurus and in Oman (Hauptmann, Palmieri 2000: 79–81; Özbal, et al. 2002: 43).

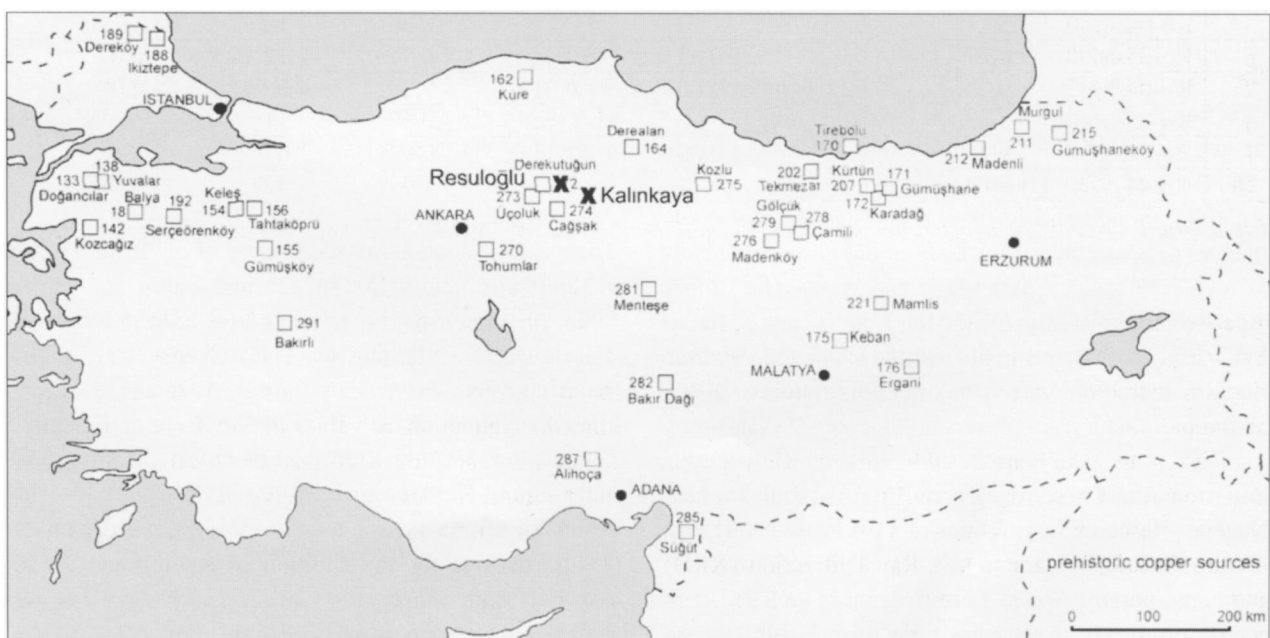


Fig. 7. Map showing Kalinkaya, Resuloğlu and surveyed copper sources and mining activities in Anatolia (after Wagner, Öztunalı 2000, with additions)

This observation accords well with the fact that the yellow beads from stone collars found at Kalinkaya (fig. 8), as well as many other sites including Resuloğlu, Balıbağ and Alaca Höyük (Yıldırım 2006: 13, fig. 18, 11), are made, as shown by XRD and XRF analyses, of Uzonite, an arsenic mineral, probably found together with other arsenic chemical compounds at outcrops such as those described above.

The question concerning the tin sources for Anatolia in the third millennium BC is still one of the most hotly debated topics in Aegean and Anatolian prehistory (Yener, et al. 1989; Pernicka, et al. 1992; Yener, Vandiver 1993a; 1993b; Muhly 1993; Greaves 2003: 11–17, 50–57) and cannot be answered by our analyses. However, the phenomenon that elaborate casting techniques were applied to influence object colour, including the expense of using larger amounts of valuable tin in order to create ‘golden’ items, certainly presupposes a reliable supply of tin ore, prior to its large-scale import and circulation by means of Assyrian caravan routes in the second millennium BC (Dercksen 1996). The well-documented occurrence of tin along the Taurus foothills is still the most convincing primary supply source for EBA Anatolia, despite the opposition of some scholars (Pernicka, et al. 1992).

Anatolia and the north: an agenda for future research

The surprising first results of the recently launched analysis collaboration are just one facet in the potential of joint archaeological and archaeometrical analyses to be carried out in central Asia Minor and its northern neighbours. The brief artefact-based study presented at the beginning tried to show that single artefacts, though known to the scientific community for quite a long time, can provide some evidence for inter-regional, multi-directional Anatolian-Eurasian communication over a longer period of time – or to express this with a slight variation of the Transanatolia symposium theme: Anatolia, though still having certain gaps in the jigsaw puzzle of cross-cultural interaction, did not serve merely as a passive bridge linking East and West. The Bronze Age communities of Asia Minor were more active, innovative participants in the cultural exchange also from north to south (and vice versa), not only transferring and absorbing fashions and technologies. On an intra-regional scale, the first results of the newly begun archaeometrical studies of metal and mineral artefacts shed new light on the activities of EBA central Anatolian communities extending to the Black Sea coast in the north and possibly to the Taurus region in the southeast.

Unfortunately, the Black Sea littoral and its hinterland, a definite contact zone in prehistoric times thanks to coastal seafaring activities especially in the third



Fig. 8. Collar from Kalinkaya burial M-02-71 with stone and bronze beads (arrows indicate beads made from Uzonite)

millennium BC (Höckmann 2003), is still one of the most under-researched regions of Anatolia. Strictly speaking, only one major site, namely İkiztepe near Bafra, has been excavated on a large scale, but with questionable published results concerning the stratigraphy and dating of both settlement and cemetery (Zimmermann 2005b: 193–94). Other excavations in the Turkish Pontic region such as Demircihöyük or Öksürüktepe (Yakar 1985: 244–45; Schoop 2005: 305–07), undertaken in the 1930s and 1940s, were either small rescue campaigns or remain largely unpublished. Intensified research, especially in the regions north and northeast of Çorum and Tokat, might yield results as enlightening as those resulting from the Paphlagonia survey (Matthews, et al. 1998; Matthews 2004: 55–66), and provide fresh evidence concerning the proposed ‘north-south axis’, which allowed the exchange of symbols and technologies in the (Early) Bronze Ages, as outlined in this paper.

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Bibliography

- Arık, R.O. 1937: *Alaca Höyük Hafriyatı. 1935 deki çalışmalara ve keşiflere ait ilk rapor*. Ankara
- Bertram, J.-K. 2005: 'Probleme der ostanatolischen/südkaukasischen Bronzezeit: ca. 2500–1600 v.u.Z.' *TÜBA-AR* 8: 61–84
- Bilgi, Ö. 2001: *Metallurgists of the Central Black Sea Region. A New Perspective on the Question of the Indo-Europeans' Original Homeland*. Istanbul
- Charles, J.A. 1967: 'Early arsenical bronzes – a metallurgical view' *American Journal of Archaeology* 71: 21–26
- Černych, E.N. 1983: 'Frühmetallurgische Kontakte in Eurasien' *Beiträge zur Allgemeinen und Vergleichenden Archäologie* 5: 19–34
- Chernykh, E.N. 1992: *Ancient Metallurgy in the USSR. The Early Metal Age*. Cambridge
- Chernykh, E.N., Avilova, L.I., Orlovskaya, L.B. 2002: 'Metallurgy of the circumponic area: from unity to disintegration' in Ü. Yalçın (ed.), *Anatolian Metal II. Der Anschnitt Beiheft 15*. Bochum: 83–100
- De Jesus, P. 1980: *The Development of Prehistoric Mining and Metallurgy in Anatolia*. Oxford
- Dercksen, J.G. 1996: *The Old Assyrian Copper Trade in Anatolia*. Istanbul
- Efe, T. 2002: 'The interaction between cultural/political entities and metalworking in western Anatolia during the Chalcolithic and Early Bronze Age' in Ü. Yalçın (ed.), *Anatolian Metal II. Der Anschnitt Beiheft 15*. Bochum: 49–65
- 2003: 'Küllüoba and the initial stages of urbanism in western Anatolia' in M. Özdoğan, H. Hauptmann, N. Başgelen (eds), *Köyden Kente. From Villages to Cities. Early Villages in the Near East. Studies Presented to Ufuk Esin*. Istanbul: 265–82
- Esin, U. 1969: *Kuantatif spektral analiz yardımıyla Anadolu'da başlangıcından Asur kolonileri çağına kadar Bakır ve Tunç madenciliği*. Istanbul
- Gambaschidze, I., Hauptmann, A., Slotta, R., Yalçın, Ü. (eds) 2001: *Georgien. Schätze aus dem Land des Goldenen Vlies. Katalog Deutsches Bergbaumuseum*. Bochum
- Greaves, A.M. 2003: *Miletos. Bir Tarih*. Trans. H.Ç. Öztürk. Istanbul
- Güngörmüş, A.H., Şen, A. 2006: 'Bor Madeni Arsenik ve Yaşam Hakkı' *Standard* 45: 100–04
- Hauptmann, A., Palmieri, A. 2000: 'Metal production in the eastern Mediterranean at the transition of the fourth/third millennium: case studies from Arslantepe' in Ü. Yalçın (ed.), *Anatolian Metal I. Der Anschnitt Beiheft 13*. Bochum: 75–82
- Horedt, K. 1940: 'Südosteuropäische Keulenköpfe' *Mitteilungen der Anthropologischen Gesellschaft Wien* 70: 283–303
- Hosler, D. 1995: 'Sound, colour and meaning in the metallurgy of ancient West Mexico' *World Archaeology* 27: 100–15
- Höckmann, O. 2003: 'Zur frühen Seefahrt in den Meerengen' *Studia Troica* 13: 133–60
- Kaiser, E. 1997: *Der Hort von Borodino. Kritische Anmerkungen zu einem berühmten bronzezeitlichen Schatzfund aus dem nordwestlichen Schwarzmeergebiet* (Universitätsforschungen zur prähistorischen Archäologie Band 44). Bonn
- Kohl, P.L. 2007: *The Making of Bronze Age Eurasia. Cambridge World Archaeology*. Cambridge
- Kuruçayırılı, E., Özbal, H. 2005: 'New metal analysis from Tarsus Gözlükule' in Ü. Yalçın (ed.), *Anatolian Metal III. Der Anschnitt Beiheft 18*. Bochum: 49–61
- Lechtman, H. 1996: 'Arsenic bronze: dirty copper or chosen alloy? A view from the Americas' *Journal of Field Archaeology* 23: 477–514
- Mansfeld, G. 2001: 'Die "Königsgräber" von Alaca Höyük und ihre Beziehungen nach Kaukasien' *Archäologische Mitteilungen aus Iran und Turan* 33: 19–61
- Matthews, R. 2004: 'Salur north: an Early Bronze Age cemetery in north-central Anatolia' in A. Sagona (ed.), *A View From the Highlands. Archaeological Studies in Honour of Charles Burney* (Ancient Near Eastern Studies Supplement 12). Herent: 55–66
- Matthews, R., Pollard, T., Ramage, M. 1998: 'Project Paphlagonia: regional survey in northern Anatolia' in R. Matthews (ed.), *Ancient Anatolia. Fifty Years' Work by the British Institute of Archaeology at Ankara*. Exeter: 195–206
- Mellink, M.J. 1998: 'Anatolia and the bridge from east to west in the Early Bronze Age' *TÜBA-AR* 1: 1–8
- Motzenbäcker, I. 1996: *Sammlung Kossnierska. Der digorische Formenkreis der kaukasischen Bronzezeit* (Museum für Vor- und Frühgeschichte Berlin Bestandskataloge Vol. 3). Berlin
- Muhly, J.D. 1993: 'Early Bronze Age tin and the Taurus' *American Journal of Archaeology* 97: 239–53
- Müller-Karpe, H. 1974: *Handbuch der Vorgeschichte. Dritter Band Kupferzeit. Tafeln*. Munich

- Orthmann, W. 1967: 'Zu den "Standarten" aus Alaca Hüyük' *Istanbuler Mitteilungen* 17: 34–54
- Özbal, H., Pehlivan, N., Earl, B., Gedik, B. 2002: 'Metallurgy at İkiztepe' in Ü. Yalçın (ed.), *Anatolian Metal II. Der Anschnitt Beiheft 15*. Bochum: 39–48
- Özgüç, T. 1980: 'Çorum çevresinden bulunan Eski Tunç Çağı eserleri. Some Early Bronze Age objects from the district of Çorum' *Belleten* 44: 459–66; 467–74
- Palumbi, G. 2003: 'Eastern Anatolia and Transcaucasian relationships during the mid-fourth millennium BC' *Ancient Near Eastern Studies* 40: 80–134
- Pernicka, E. 1990: 'Gewinnung und Verbreitung der Metalle in prähistorischer Zeit' *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 37: 21–129
- Pernicka, E., Seeliger, T.C., Wagner, G.A., Begemann, F., Schmitt-Strecker, S., Eibner, C., Öztunalı, Ö., Baranyi, I. 1984: 'Archäometallurgische Untersuchungen in Nordwestanatolien' *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 31: 533–99
- Pernicka, E., Wagner, G.A., Muhly, J.D., Öztunalı, Ö. 1992: 'Comment on the discussion of ancient tin sources in Anatolia' *Journal of Mediterranean Archaeology* 5: 91–98
- Pernicka, E., Eibner, C., Öztunalı, Ö., Wagner, G.A. 2003: 'Early Bronze Age metallurgy in the north-east Aegean' in G.A. Wagner, E. Pernicka, H.-P. Uerpmann (eds), *Troia and the Troad. Scientific Approaches*. Berlin, Heidelberg, New York: 143–72
- Pizchelaury, K. 1984: *Jungbronzezeitliche bis ältereisenzeitliche Heiligtümer in Ost-Georgien* (Materialien zur Allgemeinen und Vergleichenden Archäologie Band 12). München
- Rahmstorf, L. 2006: 'Zur Ausbreitung vorderasiatischer Innovationen in die frühbronzezeitliche Ägäis' *Praehistorische Zeitschrift* 81: 49–96
- Reilly, E.B. 1940: 'Test excavations at Tilkitepe (1937)' *Türk Tarih Arkeologya ve Etnografya Dergisi* 4: 156–78
- Sagona, A. 2004: 'Social boundaries and ritual landscapes in late prehistoric Trans-Caucasus and highland Anatolia' in A. Sagona (ed.), *A View From the Highlands. Archaeological Studies in Honour of Charles Burney* (Ancient Near Eastern Studies Supplement 12). Herent: 475–538
- Şahoğlu, V. 2005: 'The Anatolian trade network and the Izmir region during the Early Bronze Age' *Oxford Journal of Archaeology* 24: 339–61
- Schliemann, H. 1881: *Ilios. Stadt und Land der Trojaner: Forschungen und Entdeckungen in der Troas und besonders auf der Baustelle von Troja*. Leipzig
- Schoop, U. 2005: *Das anatolische Chalkolithikum. Eine chronologische Untersuchung zur vorbronzezeitlichen Kultursequenz im nördlichen Zentralanatolien und den angrenzenden Gebieten*. Remshalden
- Seeher, J. 2000: *Die bronzezeitliche Nekropole von Demircihöyük-Sarıket. Ausgrabungen des Deutschen Archäologischen Instituts in Zusammenarbeit mit dem Museum Bursa, 1990–1991*. (IstForsch 44). Tübingen
- Temizsoy, İ., Kutkam, M., Saatçi, T. n.d.: *Museum für Anatolische Civilisationen* [sic]. Ankara
- Wagner, G.A., Öztunalı, Ö. 2000: 'Prehistoric copper sources in Turkey' in Ü. Yalçın (ed.), *Anatolian Metal I. Der Anschnitt Beiheft 13*. Bochum: 31–67
- Wagner, G.A., Wagner, I., Öztunalı, Ö., Schmitt-Strecker, S., Begemann, F. 2003: 'Archäometallurgischer Bericht über Feldforschungen in Anatolien und bleisotopische Studien an Erzen und Schlacken' in T. Stöllner, G. Körlin, G. Steffens, J. Cierny (eds), *Man and Mining – Mensch und Bergbau. Studies in Honour of Gerd Weisgerber on the Occasion of his 65th Birthday*. Bochum: 475–94
- Yakar, J. 1985: *The Later Prehistory of Anatolia. The Late Chalcolithic and Early Bronze Age* (British Archaeological Reports International Series 268). Oxford
- Yener, K.A. 1983: 'The production, exchange and utilization of silver and lead metals in ancient Anatolia: a source identification project' *Anatolica* 10: 1–15
- 1986: 'The archaeometry of silver in Anatolia. The Bolkardağ mining district' *American Journal of Archaeology* 90: 469–72
- Yener, K.A., Özbal, H., Kaptan, E., Pehlivan, A.N., Goodway, M. 1989: 'Kestel: an Early Bronze Age source of tin ore in the Taurus mountains, Turkey' *Science* 244: 200–03
- Yener, K.A., Vandiver, P.B. 1993a: 'Tin processing at Göltepe, an Early Bronze Age Site in Anatolia' *American Journal of Archaeology* 97: 207–38
- 1993b: 'Reply to J.D. Muhly, "Early Bronze Age tin and the Taurus"' *American Journal of Archaeology* 97: 255–64
- Yıldırım, T. 2006: 'An Early Bronze Age cemetery at Resuloğlu, near Uğurludağ, Çorum. A preliminary report of the archaeological work carried out between the years 2003–2005' *Anatolia Antiqua* 14: 1–14
- Yıldırım, T., Ediz, İ. 2006: '2004 Yılı Resuloğlu Mezarlık Kazısı' *Kazı Sonuçları Toplantısı* 27/2: 57–64

- Zahlhaas, G. 1995: *Orient und Okzident. Kulturelle Wurzeln Alteuropas 7000 bis 15. v. Chr.* Munich
- Zimmermann, T. 2005a: 'Perfumes and policies. A "Syrian bottle" from Kinet Höyük and Anatolian trade patterns in the advanced third millennium BC' *Anatolica* 31: 161–69
- 2005b: 'Zu den frühesten Blei- und Edelmetallfunden in Anatolien. Einige Gedanken zu Kontext und Technologie' *Der Anschnitt* 57: 191–99
- 2006a: 'Bottles and netbags. Some additional notes on my article about "Syrian bottles" in *Anatolica* 31, 2005' *Anatolica* 32: 229–31
- 2006b: 'Kalınkaya. A Chalcolithic–Early Bronze Age settlement and cemetery in northern central Anatolia. First preliminary report: the burial evidence' *Anadolu Medeniyetleri Müzesi 2005 Yılığ*: 271–311
- 2007: 'Kult und Prunk im Herzen Hattis – Beobachtungen an frühbronzezeitlichem Zeremonialgerät aus der Nekropole von Kalınkaya/Toptaştepe, Provinz Çorum' *Colloquium Anatolicum* 5: 213–24
- in press: 'Ceremonial maceheads in Bronze Age Asia Minor and their cultural significance' *Anatolia Supplement* 2